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Studies on utilization of food and agricultural by-products as total mixed ration silage for dairy cows

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ABSTRACT

Three major food by-products, potato waste, noodle waste, soybean curd residue and soy sauce cake mixture, and three additives, winery grape pomace (WP), winery grape sediment (WS) and blackbean foliage (BF) were obtained. Five types of total mixed ration (TMR) silage were prepared; basal diet containing roughage and commercial concentrate, basal diet + major food by-products containing the food by-products replacing 40% of commercial concentrate on a dry matter (DM) basis, and treatment with WP (TWP), TWS and TBF containing WP, WS and BF partly replacing the commercial concentrate or roughage of basal diet + major food by-products. The ingredients were mixed and preserved in bucket silos for 8 weeks. The results showed that all the TMR silage samples were well-fermented and no difference was observed for pH, 4.26 — 4.58, among the treatments. The TWS replaced 15% of commercial concentrate had the lowest $\text{NH}_3\text{-N/TN}$ ($P < 0.05$) and neutral detergent fiber (aNDFom, $P < 0.01$) concentrations among the treatments.

Four wethers were used in a 4 x 4 Latin square design experiment to evaluate the *in vivo* digestibility and nitrogen balance of TMR silage with food by-products for dairy cows formulation. Five food by-products (i.e. potato waste, noodle waste, soybean curd residue, soy sauce cake and green tea waste) were obtained. Four types of TMR silage were used; control (C) containing roughage and commercial concentrate, T1:20% and T1:40% containing roughage and the five food by-products replacing 20% and 40% of commercial concentrate on a DM basis, respectively, and T2:40% containing roughage and the three food by-products (potato waste, noodle waste and soybean curd residue) replacing 40% of the commercial concentrate on a

DM basis. The ingredients were mixed and preserved in oil drum silos for 4 months. The results showed that the digestibility of DM and aNDFom, and total digestible nutrient content (TDN) were higher ($P < 0.05$) for T2:40% than for C. Urinary nitrogen excretion tended to be lower ($P = 0.07$) for T2:40% than for C. The results suggested that T2:40% can be most suitable for replacing commercial concentrate as TMR silage.

Six primiparous Holstein cows were assigned to a double reversal trial experimental design to measure feed intake, milk yield and milk composition by TMR fed with C or T2:40%. The intake and nutrient adequacy of TDN were higher in the cows fed T2:40% than C ($P < 0.01$), and the crude protein intake was higher in the T2:40% cows ($P < 0.05$). No significant differences were observed for milk yield and milk composition between the treatment groups, while the cows fed C had higher milk urea nitrogen content than those fed T2:40% ($P < 0.05$) with the values of 10.4 vs 9.6 mg/dL. Due to higher intake and nutrient adequacy of TDN in T2:40%, the utilization of the food by-products can be more suitable for replacing of commercial concentrate as TMR feed for dairy cows.

Key words: dairy cows, digestibility, food by-products, nitrogen balance, total mixed ration silage, wethers